

Human and Industrial Efficiency

Henry Chellaw



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HUMAN AND INDUSTRIAL EFFICIENCY

BY

HENRY CHELLEW, PH.D., D.Sc.

*Member of the Academical Society, Paris (Gold Medallist); Lecturer,
School of Economics (School for Officers), University of London*

PREFACE BY

RT. HON. LORD SYDENHAM, F.R.S.

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Dedicated

TO

MY COMRADES-IN-ARMS

OF THE U. S. ARMY

**WHO ATTENDED MY LECTURES AT THIS SCHOOL OF THE
UNIVERSITY OF LONDON, 1919**

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PREFACE TO AMERICAN EDITION

THE chief reason for submitting a special preface to the American Edition is to indicate as clearly as possible that this little book is as much American in origin and character as British. In other words, the reader will speedily recognize the deep indebtedness of the writer to American authors, and sources of both material and inspiration. Following upon a visit to the United States (where he lectured in 1913), the author never forgot the first impressions of the amazing efficiency displayed on all hands by Americans of all grades of society, and pledged himself after investigating these, to endeavour to establish some of these principles of human action in England upon his return. That this has been done

Preface to American Edition

(after serving in several regiments during the Great War), this work witnesses. How far success has been won, others must judge and time will tell. In England the book has met with a most cordial reception by all those journals and periodicals whose word of commendation is worthy of respect.

The book is hardly a book at all—indeed, it is intended as an introduction to a larger volume of a more specialized character, as stated on page 105. These pages may be looked upon as a short synthetic study of a vast field—but the reader is enticed to explore for himself by being given a series of swift glimpses of the fields which are under investigation. The brevity and terse nature of the chapters may be partly explained by the fact that the writer was limited as to time in order to meet the urgent requests of a number of students who wished to have in some form a permanent record of lectures, apart from the well-known text-

Preface to American Edition

books on this subject. Here the volume is a *précis* of many hours devoted to ex-Service men of the Allied armies.

More than one hundred American officers are already familiar with these words and ideas, having attended a course of lectures at the London School of Economics, on their way home from the war. They will possess and keep this manual as a memento of pleasurable and profitable times. We were comrades in arms and thereafter ardent students of the great Science of Industry and the Art of Life.

American industrialists will note that the author writes not as an engineer, but views this vast and complex problem from the standpoint of philosophy and psychology. We have quoted their own prophets and sought to honour their intrepid investigators, foremost among whom we will mention Gilbreth, Rudolph Binder, Professor Gilman, Dean French, Johnson, and others

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whose utterances are axioms we use for our guidance here in Britain. To the author they have been the high priests of the great cult of Efficiency, and this little book is the offering of an ardent disciple. Where names have not been stated, when quotations or extracts have been used, the indebtedness of the author is all the deeper since in some cases he could not trace the source. Our hope is that the viewpoint of the book and its chief thesis will find acceptance in a land where efficiency is the religion of its people.

HENRY CHELLEW.

*London School of Economics, University of
London. Late Devon Regiment and
R. A. S. C., Staff, War Office.*

PREFACE

By the RT. HON. LORD SYDENHAM, F.R.S.

THE war has thrown a powerful search-light upon certain evils in our present industrial system, and upon the grave dangers to which they have given rise. From the painful experience of four and a half years of dire stress, we have already learned many lessons of supreme value.

We have now to deepen and extend our knowledge of industrial conditions and needs in order to reconstruct the relations between employer and employed, as the only possible means of securing the increase of production which alone can save the nation from bankruptcy and ruin.

The existence of the present large popu-

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lation depends absolutely upon the overseas trade which has been wholly disorganized and partly lost during the war. If that trade cannot be rebuilt and extended by the strenuous and willing work of all classes with hand and brain, a great part of our people will within a few years be forced to emigrate or starve. There is no conceivable alternative.

During the war huge numbers of men and women were congregated into munition factories and were in many cases set to unaccustomed work. The result has been a revelation of the ease with which operations previously regarded as requiring long training were mastered and accomplished.

The work of women and girls, especially in the year following their employment on a large scale, was a wonderful performance, which served permanently to discredit many preconceived theories in regard to skilled labour and to prove that intelligence coupled

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with patriotic devotion could surmount difficulties previously believed to be soluble only by a highly trained minority.

The effects of overstrain in men as well as in women were soon apparent, and a committee presided over by Sir George Newman was appointed to inquire into the health of munition workers generally. The reports of this committee constitute a mine of 'invaluable information on some aspects of labour which had been far too generally ignored.

I will mention two only of the most important results of this expert investigation. It was proved conclusively that long hours and overtime caused a direct loss of production apart from the indirect effect upon the health and efficiency of the worker. Cumulative industrial fatigue was shown to be as economically disastrous as its infliction on the worker is obviously inhuman. In the second place, it became

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evident that the strain frequently told more heavily on managers and foremen than upon the manual worker.

There were many other great lessons to which I cannot here refer; but these lessons were unfortunately not at once applied in the munition factories, although on several occasions I attempted to draw attention to them in the House of Lords. In one of their later reports, the committee stated plainly that the health of the worker had suffered to a serious extent from causes which might easily have been removed.

We owe it to the war, however, that what is called "Welfare Work" in factories and workshops will henceforth be a permanent institution recognized as essential, not only in the interests of labour with hand and brain, but in order to increase production. In a pamphlet just issued by the Home Office for the information of employers, the chief matters demanding

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careful attention are summarized under the following headings:—

1. Health (spacing of work and workers, adequate light and lighting, and prevention of fatigue).
2. Safety (prevention of accidents and provision of first aid).
3. General well-being (provision of drinking water, mess rooms and canteens, protective clothing, cloak-room accommodation and washing conveniences).

All these matters will now come under the purview of the new Ministry of Health, and we may hope that a great improvement in the physical conditions of labour will gradually be attained.

Outside what is now described as “welfare work,” there are other questions of immense importance with which Dr. Chellew

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deals in this book—questions which are only now beginning to receive attention in this country, but which must exercise far-reaching influence upon industrial conditions in the future. It is not sufficient to regulate working hours or to provide greater safety and comfort for the worker. It is necessary, as the author points out, to study “the broad problem of Human Efficiency” and to carry out “more minute and scientific investigation” than has at present been undertaken. We have almost succeeded in perfecting the inanimate machine. We have too much neglected the human machine, of all others the most marvellous and the most complex, because dominated by what may be called psychological forces. It has been possible in the case of animals to produce types exactly fitted for the service of man. Can something of this nature be achieved in the case of men and women by education, environment, and inspiration? Is the ideal

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of the happy and contented manual worker, proud of his skill and achievements, and conscious alike of his duty to the commonwealth and of his absolute dependence on directing brains, which his class is already supplying and may supply in greater degree in the future, an empty dream? How are we to attain what Dr. Chelley calls "the right spirit in industry"? At least it is clear that human efficiency in the best sense cannot exist without some measure of that spirit. The only efficient worker with brain or hand is the man or woman whose heart is in "the trivial round, the common task."

To considerations of this kind Dr. Chelley's thoughtful book is devoted. As he points out in Chapter III, "it is perfectly clear that there are two fatigues, and that the most important is that of the mind or spirit." All experience proves that spirit can dominate fatigue and that men who work very long hours—hours not realized

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by the manual worker—may live to a happy old age, labouring to the last. We cannot balance brain work against physical exertion, as they have no common denominator; but within limits, it is certain that “the mind or spirit” plays a great part in mitigating physical fatigue. “The man who takes a real live interest in his work seldom suffers from fatigue.” While, therefore, the psychological factor demands careful study by all who are responsible for the management of industries, unintelligent manual work will always be destructive of the interest which the worker must feel if he is to put his heart into his task. In large numbers of operations, skilled and unskilled, there is a stupid waste of effort. The worker could produce more with less physical exertion than he is accustomed to employ, and he would gain morally from the consciousness of the best accomplishment with the least fatigue. Here is a

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wide field which is beginning to be explored, and which the worker, himself, can assist in exploring if we appeal to his intelligence and initiative. "Discharge of energy," writes Dr. Gilman, "is pleasure in proportion to amount, complexity, and freedom of delivery." In work unintelligently performed there can never be pleasure.

I regret that I have not time to give a general survey of the scope of this most suggestive and helpful book. "Thought," says the writer, "is the dominant factor in business," and I find many thoughts in these pages which can inspire the study necessary to place our industries on the basis of good-will, the only basis which can guarantee efficiency and stability. We have, as I have said, neglected the human machine in its spiritual aspects, and to this neglect our present dangers are, I believe, mainly due. At this crisis in the fate of our country and our Empire, it may yet be possible to stem

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the rising tide of revolution by earnest appeals to the patriotism of our people which has saved us from Prussian domination.

But "the former things are passed away," and the industrial conditions of the past cannot be continued. I commend Dr. Chellev's book to all who desire to obtain an insight into the causes of industrial unrest, and who are earnestly seeking the welfare of the workers, upon whose loyalty to the Constitution, fidelity to the best traditions of our race, and willingness to give honest work for their own benefit and that of the whole community, the salvation of the State from economic disaster now absolutely depends.

SYDENHAM.

August 2, 1919.

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Human and Industrial Efficiency

CHAPTER I

INTRODUCTORY

THE aim and object of this book is to stimulate interest in and focus attention upon what is undoubtedly the most important factor in the evolution of modern industrial life.

The one desire of the writer is to indicate at the very beginning that the book itself does not lay claim to be academic in treatment or scientific in character. Rather, and on the contrary, the aim herein is to

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map out the broad outlines of the problem of human efficiency along which others would proceed to more minute and scientific investigation.

The reader will look in vain in these pages for the vocabulary of the psychological laboratory.

Realizing that the industrial equation will be solved by practical rather than theoretical men, the object of the book is to indicate to the busy executive mind where the chief difficulties in industrial life exist and to offer various suggestions how they may be satisfactorily solved to the benefit of the worker in the first place, and the peace of mind of both the business administrator and organizer.

Anticipating some of those inevitable criticisms which will naturally arise in the minds of reviewers, students, and the general lay-reader, it is earnestly hoped that the difficulties of the pioneer in the

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sphere of human economics will be readily recognized and due allowance made for them.

Much of the material herein has been used in a series of lectures delivered at the School of Economics, University of London, and in addition much of what is stated in these pages has been expressed by other writers and investigators whose names are well known on three continents.

My more immediate friends, assistants, and associates at home and abroad will recognize my deep indebtedness to them for a number of ideas which have been utilized and expanded, and for which I desire to acknowledge my gratitude and sincere thanks.

To establish the importance of our subject one has only to quote from several public utterances of some of our leading men of science and industrialists. Lord Sydenham, in his presidential address to

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the British Science Guild upon "Science and Labour Unrest," recently stated:

"If the great housing problem was neglected during the years in which the present industrial system was being built up, other matters affecting the life of the workers were equally ignored, until the war turned a searchlight upon them. I have pointed out that the intensity of muscular exertion has been diminished; but industrial fatigue in many aspects persists. The monotony of tending a machine, though it may not cause physical exhaustion, does entail nervous strain, and leads to psychological effects of several kinds. Hours of work have been generally too long and not well arranged. There has been too much overtime, resulting in cumulative industrial fatigue. These and other questions were studied by Sir George Newman's Committee on the Health of Munition Workers, and we have now valuable information which, if wisely applied,

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can save the worker from undue stress and provide him with time for wholesome recreation. The study of the elimination of unnecessary movements, and of enabling work to be carried out with the least fatigue, was started in America, and is certain to make way in this country. It is claimed that, as a result of this study applied to mould-making, output was increased 165 per cent. and wages 64 per cent., while the reduction in cost was 54 per cent. In the purely manual labour of unloading pig-iron, the corresponding percentages were 150, 69, and 66. There is here a new branch of science, which can greatly benefit the manual worker, and at the same time increase production."

In a recent lecture upon the Education of Colliery Managers for Administrative and Social Responsibilities, W. Maurice, a well-known practical mining engineer, stated:

"The most important 'machine' em-

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ployed in industry is man. Every engineer is familiar with the conditions under which a contrivance will work most efficiently. He knows that a little oil, applied in the right place and at the right time, will prevent it from, so to say, 'going on strike.' He knows that metals and other inanimate objects may suffer from fatigue, and that they will break down if they are not rested. He makes careful studies of all these matters and seeks to apply all human knowledge to obtain the conditions of maximum efficiency for any mechanism in which he may be interested.

"What has he done so far, and what is he going to do, with regard to the one 'machine' without which all others are utterly useless? The human machine has, it is true, been most extensively studied in the philosophic way throughout the ages. It is, however, only recently that man has been scientifically studied as a mechanism,

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that his physiological and psychological attributes have been made the subject of laboratory research as distinguished from merely intellectual analysis. The everyday engineer continues to use the human machine with considerably less intelligence than he exerts when he is inducing a nail to follow the directions of a hammer. His methods of lubricating this 'machine' are empiric, not to say crude. His knowledge of human fatigue begins and ends with a general impression that some men are 'born tired,' and the others don't do very much. As to 'efficiency,' the popular view is summed up in the impression: the larger the pay the smaller the output. And when he is considering how to get the best out of his men, his mind almost automatically drops the essential word and he finds himself thinking how to get the best of them. The common attitude is based on experience, and is therefore in a sense true to life. But

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it is far from being the whole truth, and the day is not far distant when it will be wholly untenable.

“A reliable working of *psycho-psychology* would help the manager through innumerable difficulties. He would see what was wrong with Scientific Management, as popularly expounded, and very soon find himself convinced that the efficiency of the human machine *can* be enormously increased. And this, not, as the earlier and a section of the present exponents of scientific management would increase it, by seeking to convert an immortal soul into a mere mechanism, but by means which are definitely contributory to the workman's spiritual and physical well-being.

“The study of the coming science of *Industrial Psychology* would open the student's eyes to new adventures in research, and leave him more than ever satisfied that, for colliery managers in particular, ‘the

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proper study of mankind is man.' If he could go through a wisely directed course in *social psychology* and in *social science* generally, he would approach his life's work with an entirely new outlook, and would be far less likely to set up—or to permit others to set up—those petty irritations which lie at the root of so many industrial disputes.

"All these studies are attractive: they are pre-eminently humanistic; and, since the pursuit of them inevitably leads the student into innumerable and enchanting bypaths, he is almost automatically set going along a path of great national service."

Further, as Gilbreth points out in his pamphlet on "The Measurement of the Human Factor in Industry":

"The first step in any great movement is to arouse interest in the subject, to discuss the great problems involved, to outline the possible solutions, and to assign the various

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problems to those best fitted to undertake and handle them.

“The next step is to realize that all this discussion, valuable as it is, can grow into such action as it deserves only if measurement is insisted upon from the very beginning of making the investigations outlined, if the records of measurement are in such form that they can be used by those who did not make them, that skill and experience may thus be transferred, and if the results of the measurements are incorporated into actual and universal practice as soon as they are properly synthesized into practical methods of least waste.

“The world has come to realize the truth of this as applied to material things. The day of standardization of materials and of machines is far advanced, and is daily progressing; but such has been rarely the case with measurement as applied to the Human Element.

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“The design of machines is constantly changing; the human being is constant. Measurement on machines that are obsolete is of little value. Measurement of human beings is valuable for ever. Such old saws as ‘Genius must be unconfined and uncriticized,’ ‘Skill is not a matter of measurement or of teaching, but of natural aptitude alone,’ ‘Expertness is the same as efficiency and the expert often develops as a lone worker and with no thanks to measurement,’ have stood in the way of measurement. So have such ideas as that measurement of the human factor, and the supplying of work that this measurement shows to be the most appropriate, lead to monotony.

“Now it is a matter of no difficulty to state the facts in their proper terms to an unprejudiced and open mind. Measured investigations prove that genius develops best and fastest when provided with such opportunities as measurement of the genius

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shows as necessary, and when relieved of all restrictive occupation and distraction. They also show that skill is largely a matter of training, and that greatest skill can be acquired in the shortest amount of time when right habits are acquired as a direct result of right methods having been taught from the start, and the human factor in the learner and the teacher having been carefully measured.

“Most interesting of all, perhaps, is that recent investigations prove absolutely that while expertness and efficiency may be possessed by the same individual, often the expert is not an efficient worker. Many an expert worker in the industries, in the professions, and in the sports shows every evidence of working with speed and with a resulting output high in quality and quantity, but with a resultant fatigue entirely incommensurate with real efficiency. This is no mere theory of ours, not something

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that we merely base on 'what might be' or 'what could be' or 'what we believe is.' It is the actual condition of affairs, as we can prove by records made on recognized experts and champions in numerous lines of activity.

"As for the idea that measurement leads, directly or indirectly, to monotony—it has been the direct results of measurement that have proved to be the great factors in eliminating monotony, and in injecting interest into all kinds of work.

"Monotony is the result not of measuring the activity, or the human factor in the activity, but of wrong assignment and placement to work, or of such repetition of work that the mind is forced to follow a cycle of activity again and again, with nothing to stimulate during the process. It is the measurement that has resulted in better placement, and in assigning each individual to that type of work for which he

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will become best fitted and that he finds interesting. It is the measurement, and the theory and practice of measurement that is taught the individual at the work, that make him interested in the work itself, in his motions in performing it, and in the rest intervals that enable him to perform the most output with the least fatigue."

The Rt. Hon. J. R. Clynes, M.P., in his address to the Annual Labour Conference, speaking of Co-partnership in Industry, expressed the following view:

"Men will not aim at the highest output either to cheapen the cost of production or to give a greater purchasing power to their own wages until they are satisfied that greater output would mean greater pay for themselves.

"Without any abuse of the human element in labour a limit of physical powers should not be fixed at the point of the utmost endurance of which the human being

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is capable. A limit even to industrial prosperity should be fixed rather than work the human frame to death for some commercial end. In short, the human element must dominate future relationships, if the newer spirit on which greater success can be based is to be fostered. The spirit and the tone of workshop and factory can be vastly improved if workers are made by their experience to see that they are, in the real sense of the term, partners in industry as well as producers of various commodities. The new spirit can be fostered only when the masses of workmen are reached by a consciousness of sharing in the control of the great undertakings which they maintain."

CHAPTER II

HUMAN EFFICIENCY

SURVEYING the industrial background of modern life, no question looms larger before the investigating mind than the problem of human efficiency. The centre of gravity has shifted from money to men. As we examine social phenomena today, the human factor presents us with a task involving vast research, and calling for an equal volume of patient and cautious investigation. The fierce combat between man and the machine grows with the years, and the whole world is filled with the whirl of wheels. What will be the outcome of it all no one dare predict, but it is safe to say that now work is fast becoming scientific,

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life itself takes a new perspective, and labour is more than ever worth while. Work is ceasing to be irksome, a task, and is seen in its true relation to life and human affairs. Efficiency (a much abused word) is our verbal expression of the symbol of one hundred per cent., and how to attain it our chief problem in every department of Industry and Commerce.

WHAT IS MAN POWER?

The power of money has been amply demonstrated during the war, and the efficiency of mechanical inventions also—but, up to the present, we have not arrived at any true definition of man power. Speaking scientifically, this is an unknown power. It is futile to debate the characteristics of the Superman; so far he has not arrived—not even in Germany—and among ordinary mortals we have yet to evolve the standard

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man. Here, again, we are without axioms to guide us in our researches into the problem of man power. Ruling out the arbitrary idea that man power is one-twentieth of one horse-power, we do not yet feel confident in putting forward any statement regarding the human factor which shall be final.

The modern industrial world presents a most complex field for investigation into the background of economics. In organic industrial evolution, the attempt at simplification by the establishment of trusts and great combines creates no Utopia for the operative—the worker. Nevertheless, without men there would be neither money nor machinery. Man power is the greatest power on earth, yet we have not reduced all our findings to the nature of a graph. Man is not a constant, but a variable, and the net result of all our researches hitherto is in agreement with that statement. Here the problems are mainly embraced by the phy-

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siological and psychological sciences. With the former we have been able to achieve great results in ameliorating the lot of the worker and in general human betterment; but in the domain of the mind we have yet a great distance to traverse.

Modern industrial legislation has succeeded in removing much of the hard character of the daily task, and here the State is becoming more paternal in its interest in the worker—yet much escapes the eye of the Factory Inspector. In the realm of human betterment we have not exhausted our work. No gospel of industrial salvation has been found, for wages and remuneration alone constitute but one part of the reward of human endeavour. The responsibility of the employer does not end with the handing over of the pay envelope on the Friday. He is responsible in a larger and distinctly ethical sense for the happiness and for the general comfort of the employee. Indeed,

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we will go so far as to state that the Spencerian doctrine of human solidarity has never been so emphasized as in our day. In industry and in commerce employer and employee stand or fall together. Here, however, we need not dwell—such truths are obvious in the light of our political and social science.

THE MEANING OF EFFICIENCY

Today, as never before, we are called upon to mobilize all our thoughts, acts, and emotions in the name of Efficiency. We are summoned to the battle for bread and new weapons are placed in our hands wherewith to win in the struggle for existence. To this end we have invented whole armouries of devices, and in our offices the number of machines aiming at the saving of time and energy is legion, but we have not yet marked out distinctly the cycle of

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man power. Efficiency has been well termed "the science of self-management." Here, again, we may analyze our terminology and well ask for the content of the word "self," and the supplementary word "management." We know that man has a body and a mind. With the one he labours to live, with the other he peers into the mystery of infinity; but, turning his eyes inward upon the mystery of his own personality, he is baffled, despite his use of weird and wonderful instruments.

Let it be stated with emphasis that efficiency is not a mechanical thing; it is the science of life itself. We have it on the highest authority that the average man uses daily but fifty per cent. of his bodily power, and seldom more than twenty-five per cent. of his brain power. If this be true, the responsibility for so serious a social problem is with the educationist. We are all conscious of our latent powers, but mani-

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fold reasons seem constantly present to prevent us living a full life.

THE RIGHT SPIRIT IN INDUSTRY

Anthropometric science is as yet in its infancy, but we are making strides in the direction of solving the mystic equation of human dynamics. Notable experiments are constantly being carried out in our psychological laboratories, and various textbooks are arriving to guide us in our work, and instruments of a highly technical and specialized character also.

Classical experiments on a large scale have been conducted in human efficiency, aiming at human happiness, by the Cadburys, the Rowntrees, Lever Brothers, and others. These have proved what can be done where the ideals of business management are identical, and where employer and employee work as one. The restoration of

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the domestic spirit in industry has eventuated in larger profits and wages and greater contentment all round. This is the true place of sentiment in business, and results abundantly prove that it pays.

The general manager of today will be the labour leader of tomorrow. We know today how to utilize much of what hitherto came under the heading of waste, but we are only beginning our study of how to save time, energy, and motion on the purely human side of industry.

Since the introduction of Scientific Management, many minds have been engaged in solving this problem, and such results as have been chronicled provoke us to greater energies in analyzing the content of the word "work."

In America, the school of scientific management has given us men who have builded better than they knew. Meeting with cold cynicism on the one hand, and hot opposi-

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tion on the other, they nevertheless proceeded with their researches, and the results of their work constitute a body of teaching which has come to stay, despite all opposition on the part of Trade Unionism. Such great names as Taylor, Barth, Gantt, Hathaway, and Gilbreth, to mention only a few of the pioneers, have become almost as familiar to the up-to-date executive as those in any other department of science. Claiming to be the apostles of a new industrial era, they have closed up their ranks and fought well against those arch-enemies of the human race, prejudice, tradition, ignorance, and selfishness.

TIME AND MOTION STUDY

The more important features of scientific management deal with the twin problems of Time and Motion Study, and Fatigue Study. Much has already been achieved,

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but much more remains to be accomplished by the investigators, who must be specially trained for the complex task before them.

Foremost of the investigators is Gilbreth, ably seconded more recently by McKillop. The emphasis put into the task by Gilbreth aims at the elimination of avoidable effort. For an exhaustive survey of the problem, the reader is commended to the well-known texts by these writers.

Beginning with intensive studies by the aid of the stop watch, results were achieved which, to the man new to the subject, seem to be little short of the miraculous. Later, various devices were invented according to the nature of the problem attacked, and in micro-motion study the cinematograph has perfected all previous records and methods. The analysis of such simple operations as the folding of a handkerchief revealed that not only is there a right and a wrong way of doing most things, but further it was

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demonstrated in a close study of bricklaying that, whereas formerly a man would lay one thousand bricks per day, under this phase of scientific management, with brief instruction following upon a readjustment of tools and equipment, the same man could comfortably lay down three thousand without any extra fatigue.

A SIMPLE EXPERIMENT

The user of an ordinary make of safety razor may try the simple experiment in shaving of recording his motions over a given time, with the aid of a watch, and he will find that usually he makes nearly 250 motions to get a perfect shave—when by a close study of movement and the instrument these motions can be reduced to 60.

Whilst Emerson called his system "Efficiency," Taylor called his "Scientific Man-

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agement," but the results were largely the same in the direction of eliminating useless and wasteful efforts, and finding the standard or correct way of doing the task set.

The incentive of the workman was encouraged by a greater reward for personal efficiency in the way of both wages and bonus. The deadening effect of monotony (where standardization is aimed at) was lost in the collective aim towards the finished article—all processes of making and assembling were leading up to the one end of efficient production.

No firm can hope to achieve perfection of product without devoting much attention and spending considerable sums of money on the human plant. All money spent here is sound investment. Reduce the errors of the operatives in production and you soon discover where lies the secret of efficiency. This is the scientific way of reducing costs and increasing output. Such

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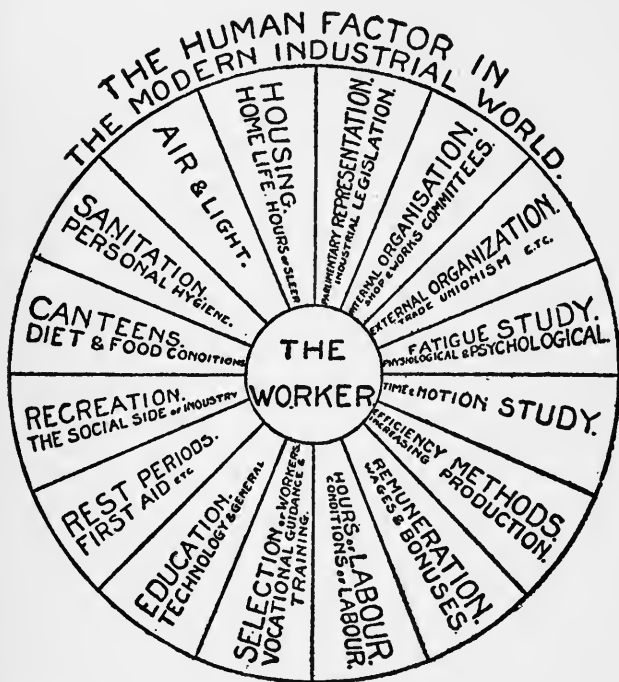
a secret has the character of an axiom. We have efficient machines, and we have efficient systems of handling money, but only now are we seriously attacking the much more important problem of human efficiency. A close study of the human unit in industry reveals to us the fact that whilst most movements of the body have a tendency to become automatic, yet man is much more than a highly developed automaton. Here we come close to the psychological field of investigation. We have not completed our map of the human mind, and thus far we are not in agreement as to the exact meaning of the word "volition."

Reference to the accompanying diagram must be made here to distinguish in a general way the main features of the involved problem of the worker and his place and power in the great industrial world.

In our investigations into the foundations of human efficiency, we very soon reach

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the problem of fatigue. Here is the province of Time and Motion Study, aiming at the



elimination of useless and superfluous motions and efforts, and wasteful methods of working. Let it be stated that the executive

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head or manager who wishes to establish this phase of scientific management need not betake himself to the task of becoming either a medical student or a psychological expert. The Psychotechnology of Münsterberg, and the researches of Baldwin and Ladd, will be time thrown away in study when experts are available, ready to place in his hands data of proved value by experimenting in factory and workshop.

FATIGUE

The Industrial Fatigue Research Board will confine its activities to this problem. In the domain of social and industrial science, this marks the beginning of a new era in these islands, for hitherto most, indeed almost all, of the research work upon this problem has been undertaken in the United States—the home of scientific management. Few text-books under either

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heading have been written in Britain, and little contribution has been made to this feature of industrial science. A beginning has now been made, under the official ægis of the Government, and a body of eminent scientists, supported by the sympathetic interest of the captains of industry, will do more to ameliorate the lot of the worker in one decade than an army of agitators will accomplish in a century.

Industry must be humanized yet more and more, and hours and conditions of labour call for readjustment in many trades and occupations.

Fatigue may be generally divided into two aspects—mental and muscular, but a strict definition here would be difficult to substantiate. The ergograph is not the only instrument whereby we can calibrate the problem.

Physiological-psychology is in its infancy, and, though much of a theoretical

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and academical character has been accomplished, the hour has come for the practical application of established principles. However, armed with the stop watch and other devices, backed by the data of the laboratory, the investigator will speedily realize that the beginnings of fatigue are to be sought for outside the factory as well as inside.

Leading up to the main problem of fatigue are subsidiary questions which should more or less be taken into consideration, and from which should emerge the co-ordination of the many departments and agencies outside whose aim is to organize and humanize our social structure.

If we accept the axiom that "Society is an extension of the Individual," it is then obvious where we must begin our research work. Ultimately we get back to biochemistry and psychology. Much may and does influence the life of the worker before

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he enters the gates of the factory, and we may briefly summarize the wider issues of the problem to be investigated.

SLEEP AND FOOD

A man who has not slept well cannot work efficiently. Again, a man who has not had proper and sufficient food cannot carry out his daily duties in a manner calculated to keep him constantly at his post. Housing and home-life may be reckoned as remote questions, but nevertheless we shall not achieve our industrial perfection until we get the State more concerned with the welfare of its citizens.

Our educational system is pedantic and most inefficient. Learning in our schools leads in the long run nowhere. The relation of learning to earning is only now being realized in its true sense. We must build a bridge from the school to the factory, and

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in Vocational Training and Guidance find the solution to one of the most urgent questions of the day.

Before we hire any man we have a right (ethically as well as legally) to know something of his medical history. Who can state for us the total cost per annum of the myriad lost hours of work on account of sickness? Scientific selection and adaptation of the worker will deliver us from a host of our factory troubles. Here again is a call for the expert adviser and the specialist—usually a medical man working in concert with the general or the works manager.

The Factory Inspector has been the guardian of the best interests of both employer and employee, but the Welfare Supervisor will add strength to our collective attempt at improving and humanizing the daily task.

Such problems as Air, Light, Sanitation, Canteens, Recreation, the provision of Rest

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Rooms, First Aid, etc., will go far in making the hours in the factory as congenial as the hours outside, but the acme will not be reached without intensive research into the whole problem. Fatigue is the parent of industrial unrest and social discontent. Work will not be looked upon as a period of penal servitude for twenty years or more, but as the most ennobling phase of existence. The work card setting out the task after research by the expert in Time and Motion Study will not be looked upon as a sentence, but as a challenge to newer and better methods of work.

All this, however, cannot be anticipated without the willing consent of the worker, and a corrected mental attitude on the part of organized labour. Propaganda must be undertaken in this field by those whose *raison d'être* is to make work within the factory conducive to health and happiness.

The provisions of all Acts dealing with

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employers' liability will lose some of their terrors when the worker takes a greater interest in his own welfare, and a deeper interest in his work.

Our hope is that the scientific investigator of fatigue will lead us to something more than the discovery of anti-toxins and an elusive bacillus. Life may not be prolonged by any appreciable stretch of years, but nevertheless the span of existence will contain elements which hitherto have been conspicuously absent in our working world and every-day life. We are assured that both the economist and the industrialist will pledge their moral support to any body of *savants*, investigators, medical and psychological, who enter the industrial field to make the human factor their chief study.

CHAPTER III

WHAT IS FATIGUE?

It is undoubted that for every man there is a certain point of maximum efficiency for a period of years—that is to say, output or productive capacity, as compared with intake or consumption.

Further, if this is true of one man it is true of all men, and thus an average can be taken showing the curve of Industrial Efficiency of a certain race under certain conditions.

A machine running at a certain number of revolutions with a definite rate of feed would produce a definite number of articles per hour, and the machine does not suffer from fatigue, only from wear, and those

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who say that modern industry tends to turn man into a machine have overlooked this essential difference and its importance.

What, however, is fatigue? Is it fatigue of the body, or fatigue of the mind? As far as the former is concerned, man may indeed approximate to a machine, but no figures have shown or ever will show that the biggest man produces the greatest output, except in special cases, and the fact that in our curves of fatigue we take an average shows that there is an inequality in man which is not proportional to physical strength. In other words, it is perfectly clear that there are two fatigues, and that the most important is that of the mind or spirit. The exhausted, but faithful horse will respond to the call of its master for another effort, and a dog will obey its master's instructions, even if it drops dead from exhaustion thereafter, but man is master of his own mind and spirit; and have

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the great men of the world ever suffered from fatigue of the mind, or, if they have, have they not fought and overcome it?

Look at Clemenceau and his indomitable spirit! Is it greed that makes him work, desire for money, or power, or show, or anything that the pseudo-Socialists pretend is the driving force of humanity and the cause of civilization? A million times, No! It is merely that greatest of virtues, Love of Country. To love your own family, work for them and protect them, is indeed worthy, but in that man is hardly better than an animal; but a nation which consists of an aggregate of homes can only appeal to a man's altruistic sense, which is denied animals, so that patriotism, or love of your country, is the principal line of demarcation between man and animals.

But we cannot all be Clemenceaus, although it is an undoubted fact that no successful man—that is to say, deservedly

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successful man, one who has achieved his success by his own efforts and not at the expense of others—has ever allowed fatigue of the mind to overcome him.

Does the man who works ten, twelve, fourteen, sixteen hours a day—and real work, that is, concentrating all his energies of mind and body on what he is doing—not suffer from fatigue? Of course he does, but he does not think about his fatigue, but about his work.

The inefficient and the lazy envy the successful man, for when a man works hard but is not successful, as often happens—for there is luck, after all, in this world—they say he is a fool; and have they ever realized that a man who does his appointed task and no more remains what he is, whereas the man who throughout his life does more may become, in himself, a hundred or a thousand men, for that extra little bit of work day after day, week after week,

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year after year, means that in this one man is stored knowledge and experience, which thousands of men together cannot equal? There is no simile in nature, because man's power of accumulating knowledge is unlimited, his mind knows no frontier.

Returning now to our curves of output and fatigue, it becomes obvious that instead of accepting the average figure as a fact we ought to look upon it as a starting-point and endeavour to raise all men, not to the average, but to the highest point—and it is possible. It is merely a question of a man taking an interest in his work. No one really likes work, yet civilization depends upon work, and the most civilized man is one who has compelled himself to overcome his natural disinclination to work. Interest is the secret of concentration.

The skilled artisans today show little better spirit, for had they realized that they are the wealth-makers, or that all

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wealth is due to skill and brains, they would never have permitted the unskilled workers to usurp authority or dictate to the rest of the community their share of the wealth in the production of which they are the least important factor.

The pretence of the social reformers that machines have killed the interest of the workers will not stand examination, for if every man desired to do his best he would take an interest in his output and would think how this could be increased, and every day he would go home and feel that he had done something worth while.

The cause of industrial mind fatigue is due to the delusion that whereas a man works for a wage, his employer works for profit, whereas the employer has first of all to work in order to pay his wages. The relation between wages, work, and profit is, however, a matter of pure economics and belongs to that branch of science.

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FATIGUE AND EFFICIENCY

It is difficult to determine precisely the content of the phrase "Mental Efficiency." Consciousness consists of a variety of mental states, chiefly that of feeling, which may be likened to a change in the temperature of the stream of sensation entering the mind.

Every human being is more or less a perpetual riot of thoughts and feelings, and the greatest of all arts is the art of self-control. Possibly in the absolute sense no human being has ever achieved this desirable end. It may be regarded as an axiom that before we can control ourselves we must know ourselves. Will-power for effective action is the one desideratum of all human studies. We have only to watch some men at their work speedily to recognize the fact that they have the utmost difficulty in escaping from their ancestors.

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The day is not far distant when, in addition to a man's medical history, supported by adequate testimonials as to his ethical value or degree of reliability, we shall find it necessary to ask every candidate for employment to produce his personal efficiency chart, and from that data remuneration can be fixed, and only in this way or some such way, when both body and mind have been examined, will a person be employed, adapted to the task, and if necessary trained for it, and so work will become scientific and the highest results be obtained.

It is a totally wrong idea that man is merely a machine. Man is a machine plus something indefinable which has never been fully explained by either philosopher or man of science. Fatigue of the mind is the most troublesome of human ills, but a man must be taught how to be the master of his mind, and the most successful men in business are those who fight hardest

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against this form of fatigue and continue to carry on the work. It is the extra work and the overcoming of fatigue which give him his experience and success and make the successful man the envy of the inefficient.

The elimination of fatigue will often be solved, not by some mysterious laboratory process, but by a mental effort on the part of the individual.

The man who takes a real live interest in his work seldom suffers from fatigue. Interest is the secret of concentration, as much as observation and comparison explain effective thinking. Few men really like work as such, and, with many men, one of the greatest battles in life is to overcome this incipient disinclination to work.

The human mind is the unseen power which dominates the business of the world. Without the mind of man we should have neither the machinery nor money which is essential to carry on the work of life.

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However strange it may sound, the human mind is the least developed side of a man's life. Mechanical efficiency reached a height undreamed of a decade ago, but the scientific development of the human mind is only just begun, and if we are to reconstruct the life of the world and increase our general output of work, we must begin to look for the improvement of the individual as well as the machine. Here, however, the great fault lies in the direction of the fact that so much of human energy is allowed to run waste. The work we do must be of some practical value or else it is nothing but physical and mental strain and a vast volume of wasted labour.

A man has two kinds of work to perform in this world, physical and mental, and if it is true that the average man uses fifty per cent. of his bodily power and about one-fourth of his brain power, it is small wonder that the world is filled with more

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or less useless effort. Someone has facetiously said that a man is worth but 4s. per day from the chin downward, but no one thus far has been able to calculate the value of the mechanism behind and above the eyes.

This is the great problem confronting our modern psychologists. No form of engineering is so great in importance as Human Engineering, as Edison so aptly termed it. We understand full well the power possessed by money and machinery, but we do not yet realize what man power really is.

As we have already indicated, the centre of gravity has shifted from money to men in business. Man counts everywhere, all the time, in everything. Therefore it is our duty to make the most of this great factor lying within our grasp. In order to do this we must begin in school life to train the individual to be efficient by improving both

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physical and mental conditions. It is true that we have made some progress in improving man bodily, but with regard to mental improvement we have far to go, and with such imperious facts before us we express our profound regret that no means of industrial salvation has ever been found.

It is a mistaken idea that the employer's responsibility ends when his men are paid their wages. For is the employer not to-day more than ever responsible for their welfare when they are outside the factory as well as inside? Because he engages at least one-third of the life of each individual in productive effort, it is therefore his duty to provide them with some means of healthy recreation, and in this respect the example of the Cadburys marked the beginning of a new industrial era in these islands.

It is futile to ask "Does it pay?" for here the results are not only a hundredfold, but sometimes a thousandfold. Take the other

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side of the picture, a factory built in an evil neighbourhood, closed in with dirty windows, no stops for rest, no canteens, no welfare work whatever, the whole place looking like the combination of a prison and a workhouse, and then ask what right the employer has to look for efficiency of production, ever-increasing profits, and a swelling balance at the bank. This, to say the least, is a *reductio ad absurdum*. This is the reason of industrial unhappiness, ceaseless strikes, war between capital and labour, and subdued hatred of employers as a class. Never under such conditions will the maximum of result be obtained with the minimum expenditure of time, energy, and money.

The power lying dormant in man is an unknown power, though here we are not contemplating the Superman. We are all conscious of our possibilities, though we seldom realize them, and when we look

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backward we note innumerable occasions where we could have done better with a little more forethought and effort. The fact is, the average man will not plan his life, therefore he either stands idle, or marks time and watches others pass him on the road to preferment. He has little courage to face the future, is possibly handicapped by the past, stands hesitating in the present, and is often content to let well alone. Until he is lifted from the rut in which he finds himself and given the impetus to forge ahead, there is little hope of any progress being made. Here, then, we have to give attention to Scientific Management; having observed the results achieved by the application of the scientific method to business in America and in our own country, we are strongly of opinion—indeed, it is our conviction—that here we shall find the true solution of those evils which constantly smite us inside and outside our factory life.

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Scientific Management aims at the elimination of all avoidable fatigue, waste of effort, and useless motion. It is obvious to remark in the first place that the establishment of such principles will confer an inestimable boon upon the worker, for we are well aware that in every factory and organization there is much wastage of time and effort.

If the reader will betake himself to the books of Gilbreth, McKillop, Münsterberg, and others, evidence will be given in substantiation of these statements of an unimpeachable character. In this connection it is the intention of the author to supplement this present volume, which is of a general character, by a further volume upon Industrial Psychology of an intensive and exhaustive character. When we have been able to find out a man's capabilities, and to make a map of his mind and a general chart of his efficiency value, we shall

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then be able to fit him to a task whereby he will be able to attain his highest degree of efficiency. But unfortunately this branch of what is a new science has not had enough attention paid to it to render the results of investigators of real service.

“Speaking in general terms, a man is efficient in business life when he devotes his energies to the tasks which lie before him with such wisdom that all are properly and successfully done. It has been well stated that to get a clear idea of efficiency let us think of man as a bundle of energy, mental and physical, which must expend itself subject to the law of space and time, the highest degree of efficiency being obtained when a given amount of energy is so wisely directed that a task is completed in the least possible space and after the lapse of the least possible time.

The essence of efficiency is the economy of energy, time, and space. When any

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one of these three is wasted, or consumed without a desired result, we have loss of "efficiency."

We need a new type of engineer who shall be called the Human Engineer. His qualifications shall be training in physiology and medical science, studies and research in a psychological laboratory, and full knowledge of the conditions which obtain within the walls of the factory, supplemented by adequate information with reference to modern industrial legislation. In such a person we should combine ideal elements, and if attached to the general manager as a specialist, his services would soon be reckoned as indispensable no matter by what term his position on the executive was called. This is the age of specialization, and inasmuch as no man can in himself discharge all executive functions, the wise business administrator will therefore seek for such person and if necessary pay for his training.

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THE PSYCHOLOGICAL FACTOR

It has been observed that the work of the world depends on two factors, viz., persons and things, or, to use another phrase, the dynamic and the static factors. Too much thought and attention have been devoted to things, and consequently the true place of the human factor has not been discovered.

But we are now beginning to realize that, in the competitive business of the present day, mental power is far more important than material power; the old order of things must be reversed. Up to the present we have first considered machinery and then we proceeded to think of men and the conditions of their labour. Now, however, we are beginning to think of man first and machinery second. The efficient human factor is what we are seeking for in the present world of business. It is the thinking man that we require.

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But what is thought? Thought put into iron makes an engine, thought applied to sound produces the *Messiah*; thought is put into a quarry and a cathedral rises; thought put into stone creates a city; thought put into our factories and organized for efficient production produces a myriad things to supply the needs of the world.

We fully realize that thought is the dominant factor in business. Men are paid more for mental capacity than physical ability. As is the case with electricity, so with thought: we do not know precisely what it is, but we do know how to harness it and direct it into productive channels to make it accomplish whatever work we wish to do.

All the knowledge which we gain enters the mind through one of the five senses. We begin to sense and think; thus mental and physical energy are set up in the brain in the form of vibrations, and so feeling

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and action result. We may say that feeling depends upon thought. Here we are reminded of what Shakespeare says: "There is nothing either good or bad, but thinking makes it so." We feel infinitely more than we think; indeed, we may say that in the life of the average man one-third is intellect and two-thirds is sentiment. The chief aim of the business man should be so to control his feelings that he can think more clearly and act with greater decision and precision. Chaos reigns where sentiment controls judgment. The whole secret of clear thinking lies in the two words "observation" and "comparison." It is essential that the five senses are trained correctly, then our thinking and working will be efficient, and here we have the foundations of our Science of Efficiency. The following observations of Dr. Joseph French Johnson are very significant on this point

"Know thyself!" Socrates, the Greek

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philosopher, held that a man took the first step toward knowledge when he recognized the fact that he knew nothing, and that the second step must be to study himself.

“Socrates was right, but very few people know what he really meant. Most of us do much more idle thinking about ourselves than is good for us; what we would do if we were rich, how brave we would be if our courage could only be dramatically tested, what great things we would accomplish if we only had opportunity, what useful books we would write if we could only travel, how much good we would do in the world if we only had power. But all this is just dreaming and romancing about oneself. It is not studying ourselves. The object of study is to get a knowledge of the laws which phenomena obey. We study astronomy, for example, to discover the law which controls the movements of the planets in the heavens. We study chemistry in order that we might

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know the laws governing the combinations of material elements. To study yourself, therefore, means that you must think of yourself impersonally and endeavour to find out what you are capable of doing and what motives impel you to action. Many a man knows less about himself than he does about his horse or his dog. A spirited horse cannot be safely driven by a man who does not know him. Most of us study our friends more than we do ourselves and could pass a better examination on their qualities than we could on our own. A man is too prone to think that he can accept himself as a highly finished product and that this world would be a paradise if only other people were better.

“You are a very complicated machine, and you are always the person that can drive it, or in any way improve it. Your friends may know a great deal about your powers, mental and physical, and about

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your deficiencies and efficiencies, but they cannot remake you. If you want your machine to be in the best possible running order and to do the work for which it is best fitted, you must know it more thoroughly than you do your horse or dog. Once knowing your powers and their limitations, you will then be able to set for yourself a goal which you can reach.

“What, then, is personal efficiency? We get the root meaning from the Latin word *efficio*, which means ‘I do thoroughly.’ A man becomes efficient when his mind is organized and he devotes his thinking capacity directly upon all the activities of his life. The essence of efficiency is to think out the very best means of economizing materials, energy, time, and space.

“It is one of the greatest tragedies in our modern civilization that we have so few real thinkers. Many business men neglect their thinking powers and have little

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use for the intellectual life as such. Converse with them outside the region of their own particular line of business life and we soon find that their mental capacity is strictly limited. The real reason of this is that they do not and will not use their capacity to observe and compare. Mental poverty is the great barrier to executive power."

Personality may be split up into four divisions: first intellect, secondly feeling, thirdly body, and finally will-power. To achieve personal efficiency a man must obtain all four of these, and above all things, to become mentally efficient he must cultivate his thinking, observing, and reasoning powers.

To possess effective feelings, he must develop his ambition and his loyalty. These are fundamentals in our examination of the word "service." Strength and health must be cultivated to obtain the maximum of health of the body, and if a man is to become

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efficient in will-power he must develop his initiative, decision, and perseverance. The chief of the five senses necessary for the development of the successful business mind are seeing and hearing. The great reason for high expenditure in business today is that so much supervision is required, employees have to be told how and when to do a thing, and because their work has to be checked so often they obtain comparatively small remuneration.

It is essential that the cost of supervision should be reduced; this can only be done by Staff Training. The minds of the operatives must be well trained and organized before we can do away with the great volume of waste. Men must be taught to think, see, and remember, and their initiative must be encouraged. This is one of the tasks of Applied Psychology and one of the most important departments of Scientific Management.

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Only by the application of the Scientific method can we reduce supervision and eliminate the fatal factors of waste and fatigue. Business men must be taught sanity of outlook. They sigh for new worlds to conquer, but they cannot take advantage of the ground already lying within their grasp. They overlook the fact that much more depends upon their own personality and efficiency than on the bank balance and the armies of employees they engage. When they are themselves efficient, they must teach their employees to be so too. In business no man can afford to make mistakes, for all mistakes have to be paid for, sometimes by both the employee and the employer. In Scientific Business Management the training and fitting of employees for the task is the one ever-pressing problem. A man in whom the five senses are highly developed is infinitely more valuable than the one whose senses

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are undeveloped. The man who has been the subject of intensive mental as well as technical training is able to render much greater service to the employer.

Our task then in the future is to specialize more upon what we may reasonably term the human plant. The advent of the psychologist in the factory is the most momentous step in modern industrial evolution. This type of specialist engaged upon human engineering will do more in one year to promote efficiency of organization than an army of factory inspectors in a decade. Engineers are greatly concerned with the efficiency of the mechanical plant and the processing of material through the factory, but the human engineer goes to the very root of a problem of production.

The accountant will still continue to indicate where profits are leaking, the industrial engineer will chart out and mark the curves of inefficient production, but the

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industrial psychologist who aims at the elimination of fatigue and wasteful movement will achieve results little short of the miraculous.

The first and only problem for any executive or operative is himself. We talk with pride of Livingstone, Peary, Scott, and Shackleton, but the greatest discoverer in the world is he who has discovered himself.

Men differ quite as much as dogs. No dog fancier would think of training a water spaniel to do the work of a pointer. Temperament or disposition seems to be fundamental and unchangeable. A man who wishes to make himself 100 per cent. efficient must certainly take it into account.

A man of a highly mental and nervous temperament should manifestly not enter upon a career in which physical endurance or muscular power is essential to efficiency. A man who dislikes intellectual effort, but loves physical activity, should choose a

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calling in which muscular dexterity and power are a real asset. The man who instinctively dreads loneliness or monotony, but who will work with tremendous energy if he has companions and variety, should choose a business which will give him plenty of human contact. The man more given to meditation and philosophy than to action should not assume business responsibilities. He may be a fairly good routine worker in business, like Nathaniel Hawthorne, the great American novelist, or like Charles Lamb, one of England's choicest essayists, but he will not be really a business man.

If a man studies himself he will know his own temperament and be in a position to choose that career for which he is personally best fitted and to fit himself for it by the right kind of training. What his training ought to be depends entirely upon the peculiarities of his temperament. A standard training suitable for all is im-

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possible. Each man must be his own schoolmaster.

It must be evident that a man cannot do all that has been prescribed unless he has trained his mind to be an obedient servant. The whole aim of education on the intellectual side should be to develop the power of clear and honest thinking. A man whose mind delivers to him judgments perverted by passion or prejudice has an inefficient mind. His first duty is one of mental discipline. He must correct his mental bias and make his mind look straight into the heart of things.

It is exceedingly difficult to convince a man that his mental processes are not entirely normal.

And, of course, it is almost paradoxical to expect the man to discover the fact himself. This is one of the reasons why it is so important that a country's educational system be of the right kind, and that our

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public school teachers seek to develop their pupils' judgment and reasoning power as well as to store their memories with information about matters geographical and historical. To be on the safe side a man seeking to increase his efficiency should assume that his mind needs all the training that he can possibly give it. Perhaps he cannot go to a school or to a university, but that is not necessary. Scientific books are numerous and cheap. Let him take up some science and thoroughly master it. Let him think as he reads, and so discipline his mind in the pursuit of truth. No man is too old to take up a new science with interest, and no man's mind is so fine and efficient that further study and discipline will not improve it. The man who lets his mind lie fallow for long intervals will often fall.

If the maximum possible value were produced by a given effort, the efficiency

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would be perfect and might be properly expressed as "1" or 100 per cent. In point of fact, when dealing with human beings, it is impossible to do more than compare the efficiency of different individuals; but it is very noticeable that one man may be more fatigued by a given task than another, not only on account of his different physical state, but owing to the different manner in which he performs the task, whether it be physical or mental. Should the work required to be done vary, the efficiency should be kept at its maximum, and the effort thus saved be used either in further productive work, training, or recreation.

There are four main factors in the production of wealth—material, energy, time, and direction: energy is here used as the source of all mechanical forces whether in coal, a waterfall, the tides, etc. (external), or muscular (in a human being). "Direction" signifies the part played by intelli-

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gence in production, whether it is the skill of the miner which enables him to make the best use of his muscular power and tools, or of the man of science who invents a new process, or of the organizer who applies and carries out the process. Of these factors the last is the most important, at any rate from the point of view that only by its development can the productivity of industry be materially increased.

An individual engaged in business may have at his command, in greater or less degree, capital, connections, strength, technical skill, and other personal qualities. The two first have always been produced for the individual, possibly by him, through the exercise of the last three; thus we see that the fundamental values of the individual are his strength, skill, and personality.

These qualities are the resultant of heredity, environment, and training acting through and on the individual—"through"

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in so far as he is able by the exercise of his will and partial power of choice to select his environment and training and determine the use he shall make of them. The importance of the power of the individual to control his development cannot be overestimated.

The higher the position held, the greater the importance of personality in business. Every possible quality has either a helpful or a hindering effect, which we may express by calling them positive and negative qualities. Some qualities are invariably positive or negative, whatever the conditions and in whatever intensity the qualities exist, but others may need qualification. Thus laziness is always a vice, but strength of will, though generally a virtue, may cease to be one if carried to extremes in certain circumstances. Strength of will must be qualified by adaptability and respect for authority, generosity by the sense of one's

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own advantage, self-confidence by discretion, but honesty, energy, sympathy, power of concentration, etc., can be nothing but assets.

The power of perception, conception, analysis, synthesis, and reason must be continually at work in order to make the best use of the available factors of production—in fact, in order to realize what factors are available; for instance, in hardly any factory is the force of gravitation made sufficient use of, or the factory designed so that it can be used to the greatest possible extent. In the organization of a business, besides appreciating the monetary situation it is necessary to learn from past experience and to be able to forecast the future; these functions give scope for every faculty.

But it is in actual dealings with men, face to face, that the importance of personality is most marked. Problems of labour control and organization are assuming

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greater importance every year, and in order to deal with them satisfactorily, broad views, a deep knowledge of human nature, and the power of appreciating the point of view of others are most necessary. If the character and personality of an employer are not such that his employees are naturally disposed to trust him, there will be continual friction and loss through discontent. And it is not only in dealing with labour that personality is important, equally important is the handling of equal or superior officials of the business and possible customers outside it.

CHAPTER IV

APPLIED PSYCHOLOGY

INDUSTRIAL Psychology is the youngest of all the sciences, and like all new sciences the pioneers have great and manifold difficulties to overcome. The devotees to the laboratory method do not take kindly to the views and methods of those who, in the world of men and machinery, have been able by experiment to prove the practical utilities of this branch of research. Whilst acknowledging our indebtedness to them we shall look in vain for industrial peace to the expert with the stop watch and the ergograph. We should appreciate much more their elaborate discoveries if they could prove to us that they really under-

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stand how smoke comes out of a factory chimney.

The human machine is the most wonderful of all instruments, and thus far, although we know how it works, we do not know why it works. Indeed, it is quite safe to say that thus far we have no definition of the term "man." Both theory and definition alike have failed singularly here, and all we do know is that man is a body and a mind, and with these two things he has been able to perform all the wonders of the industrial and business world which we see around us today, after experimenting with countless types and forms of civilization. With his mind these things have been planned and projected, and with his body they have been executed with results often disastrous to himself. It is more than obvious that both body and mind are subject to fatigue, and this perplexing problem is not only the most interesting, but one

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likely to yield the most useful results in making work worth while.

The chief bone of contention is: How can we eliminate fatigue or at least reduce it to a minimum? Speaking empirically, we must look after the man properly. It is more than obvious that he must have food, but few men indeed know how, when, or what to eat. Again, the worker cannot be efficient unless the air of the shop or factory is purified and kept at an even temperature. To this end all workshops must be ventilated properly, but even then few men know how to breathe properly. And beside these the lighting conditions must be adequately adjusted to the task, and finally, without sufficient sleep and rest no workman can be expected to arrive in the morning in a physical condition equal to the demands of the day. Here it may be useful to observe that effective or efficient sleep does not depend on the time factor, but rather on

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the quality or condition of sleep obtained. Sleep must be quiet and restful, without any disturbing influences arising from within or without the body, and it is essential that it should be in the proper bodily position, which, in other words, means that to sleep properly the knees should be drawn upwards and not stretched out at length. All these things and a thousand others the workman must be taught either inside or outside the factory, if we are to cut down fatigue and the inevitable collective industrial unrest ensuing.

The most trustworthy psychologists in their text-books indicate that the average man is only 50 per cent. physically fit and about 25 per cent. mentally efficient. This is a startling fact.

Man has achieved wonders with the human hand, the most perfect of all instruments. We may even say that with the human hand he has subdued nature. If

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the great war has taught us one lesson above all others, it has taught us that thus far he has not subdued himself.

It comes with startling effect upon our ears to be told that the human mind is capable of doing only three things.

However great the intellectual capacity, only these three things can be performed by the individual mind, but it follows that a highly organized intellect can perform them much more efficiently than a weaker or undeveloped one. Speaking in general terms, the body provides the muscular and physical energy and food for the mind, whilst the mind does the planning and acts as the administrative department. It is as though the body were the engine house and the mind the dynamo.

At this point it may be well to indicate that the most pressing problem in the industrial world today is the elimination of waste; and the greatest waste of all is that

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caused by the human factor. Myriads of men are placed in positions and given tasks entirely unsuited to them by nature and experience, and consequently work is done more by guesswork than by knowledge. It should be the aim of every business man to find the right way of doing things, get the right man to do them, and see that they are done in the right way. Then, and only then, will knowledge be substituted for guesswork, which is the daily religion of the average man.

To obtain personal efficiency we must get the maximum of result without injury to health. Health and working efficiency go hand in hand. We must eat, sleep, drink, and breathe properly. This will give us bodily health. Our trouble is to know how to become efficient in mind and body, and to mark out the frontiers toward which we may safely go. Recalling an ancient saying with reference to the possibilities of

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man, "It doth not yet appear what we shall be." Man has achieved such prodigies that we may claim some sympathy with the cult of the Superman.

THE SCIENCE OF WORK

Before proceeding to the further chapters of this book we purpose in this to support our main argument by quoting *in extenso* from the texts of various writers of authority upon the problem of the Human Factor. This will substantiate our main argument and indicate by a consensus of opinion that the subject, though looked upon as new, is being investigated by many minds.

We are now at the beginning of a new science, the object of which is to apply the Scientific Method to all forms of human endeavour and to eliminate for ever, we trust, the ceaseless interrogation "Is life

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worth living?" Let us first of all find out the content of the word "work," and then proceed to outline in its main features the Science of Work.

If we can do this we shall settle for all time one of the greatest of industrial problems, viz.: "What is a fair day's pay for a fair day's work?" In all phases of human endeavour, heredity is a tremendous factor in the expenditure of energy. Impulses stream constantly into the brain both day and night, leading the worker to move along two main lines, the line of heredity and the line of environment; and when we analyze the problem of volition, a point is reached where the individual has to decide which of these impulses should be restrained or allowed to pass into the zone of energy. It is in this zone of energy that a man's work is accomplished, and as he works, habits are formed which sooner or later create a tendency to make the life of the individual

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automatic. Probing into the origin of the word "habit," we soon reach the conclusion that a man either has habits or the habits hold the man.

It is the man who, being conscious of the struggle between thought and feeling, overcomes feeling by the exercise of self-control and so masters his habits and does not waste either time or energy.

Work implies all forms of activity, either mental or physical, on the part of man, with a view to providing sustenance for the future apart from the abounding gifts of nature. We must either work or starve. Animals and savages rely chiefly on nature, therefore they frequently starve. The finest thing which ever happened to man was when he was turned out of the Garden of Eden and made to work.

To mention the well-known classification of Dr. Rudolf Binder, Work is divisible into three classes, first Toil, then Labour,

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and finally Work proper. By the word "toil" we mean the application of mere physical energy to overcome an obstacle, and because it usually implies that someone else has set the task, therefore no one likes it. On the other hand, labour is the application of physical and mental energy for the accomplishment of a task, both the task and the method being set by another. This is also distasteful to the majority of men. Work proper is the application of both physical and mental energy for the accomplishment of a self-set or enjoyable task. There is a zest in real work which always brings happiness.

Compare, for instance, the motives of a man at a machine, and an author writing a book. The latter expends six or seven times as much energy on his work as the former does on his labour, and yet as a rule he is much happier. The task of the author is self-set and therefore he is much happier

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than the labourer, whose task is set by someone else; thus he is seldom happy. All men incipiently believe in self-direction, but few men exercise self-control.

Here the words of Dr. Gilman are pertinent:

“If a man is rightly placed in the world’s work, doing what he is best fitted for to the height of his best powers, and if he clearly sees that by so doing he fills his place in the universal economy perfectly, then, granting of course that he is properly nourished physically and socially, he is happy. But if he is ill-nourished he is unhappy, not power enough flowing in. If he is ill-placed in social service he is unhappy, lacking right lines of discharge, his energy banking up and pushing against right doors that don’t open, and moving very slack through wrong doors that do. Moreover, though well-nourished and well-placed, if he is hag-ridden by some ancient

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lie about work being a curse, a disgrace, or some such idiocy, then he is unhappy because his own mind, clogged and twisted, turns on cross-currents of pressure that spoil the smooth flow of energy. To recapitulate:

“Life is action.

“Action is conscious discharge of energy.

“Discharge of energy is pleasure in proportion to amount, complexity, and freedom of delivery.

“Social action involves greatest amount and complexity, and so, with free delivery, greatest pleasure. Our free delivery is checked by wrong conditions and wrong concepts.

“By altering the concepts we can alter conditions and so make social action normal.

“Work is social action.

“It is the expression of social energy for social use.

“It is essentially collective, and we find

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work most highly developed among most collective creatures, as the ant, the bee, and man.

“It involves a higher degree of intelligence than the preceding processes. All the efforts of animals to take food are excitomatory, and either egoistic or, at most, familistic. They are hungry, they desire something, and they go to get it, performing whatever actions have become necessary in the pursuit. But work is the process of making, not of taking. It is not excitomatory, but the result of cerebral action.”

In these forceful words the distinguished author emphasizes the place which the mind occupies in the field of the world's work, and few, if any, will take exception to the argument so ably expressed and logically sustained.

Here then, inevitably, we have to consider work as Applied Psychology, and it would be correct to indicate that, there-

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fore, animals do not work. Work always implies a direct and definite end in view. Work involves planning and scheming, method and the application of scientific principles. Here the objection might be raised that squirrels, bees, ants, etc., engage in work, but a little examination into our terminology will reveal the fact that such is not the case, for with them all there is no conscious planning. They follow out what is a natural instinct to provide for the future. Of them it is true to say they only live in the present. Only human beings have the ability to look into the future, and this ability depends upon a super-state of consciousness such as is not possessed by the lower creatures. Both savages and children are lacking in this respect, and only by education and training can this deficiency be obviated.

Most of the time and energy of the savage is spent in hunting and in war dances, but

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he does himself little good, as he has not the ability to see into the future and seldom is able to meet an emergency. Therefore his life is an alternation between feasting and fasting. Work requires patience as well as skill. The savage makes up his mind on the spur of the moment, but inventors like Edison, Marconi, and Tesla think for very long periods, sometimes for years, before they bring their mental creations to birth.

Rome was not built in a day nor Westminster Abbey in a century, and with these two examples before us we see the significance of the term "work." Someone will say that a genius makes up his mind on the spur of the moment, but this is seldom right, for genius is the infinite capacity for taking pains. Great patience must be spent on work. On the one hand it is quite true that in many phases of human work "He who hesitates is lost," and on the other it is

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equally true that "He who does not hesitate is lost."

To refer to Dr. C. Gilman again:

"Work is in two main lines, Production and Distribution; to make something, or to hand it about, is human industry."

"To create is an intense satisfaction; to combine elements and produce new results, whether it be a bridge, a basket, or a loaf of bread—to make is in itself a joy. But so is it a joy to give something to somebody, whether at first hand, or in a combination with many; to spread, to disseminate, to feel the current of human good flow through you; both functions are happy.

"The universe is an everlasting production, force taking form. energy embodied, disembodied, re-embodied—this is the game of living. Our little mid-station of consciousness feels the pressure of natural forces on both sides, pushing in through the sensory nerves; pushing out through the

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motor nerves. Owing to our early mistake about the superior pleasure of impression, and our perverse insistence that expression is only a guarded outlay of limited force, by which to secure desired impressions, we have only understood the nature of human production.

“The pleasure of right impression is not to be denied. Every sensory nerve should have its proper stimulus. And man, with his immense collective sensorium, with his highly developed personal sensations, due to social evolution, and his power of feeling with and for other people, has enormous capacity for the reception of pleasure. But what is all this pleasurable stimulus for? The brain is not merely a reservoir for stored sensation. A sensation is a certain amount of energy going into the human battery. Once in, it must be discharged in commensurate activity.

“Most interesting experiments in psy-

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chology are being made today, proving this even in some immediate result of a strong mental impression in unconscious bodily motion, as shown in studies among school children. As the brain develops it has increasing capacity to receive impressions, to retain and to arrange impressions; but, nevertheless, sometimes that mass of impressions must come out in commensurate action, else disease ensues. The human brain, socially developed and socially stimulated, has great power of expression; that expression is in work, and work is in Production and Distribution. The productivity of the human race, even with its past and present checks and perversions, is the wonder of the ages. Guaranteed swift and easy satisfaction of those 'wants' our economists build so much on, the steady increase of impressed energy has resulted in as steady an increase of expressed energy, necessarily.

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“Man receives stimulus from a thousand sources. Since we made mental impressions permanent and exchangeable ‘in book form,’ knowledge and emotion bottled, preserved, and distributed broadcast, there is practically no limit to human stimuli; and, since with this increasing stimulus we have steadily reduced the difficulties of execution, our real problem is, how to provide right outlets for the productive energy of humanity. This normal increase of power and execution we have managed to check, however, quite materially. We have gravely interfered with the natural distribution of stimulus up to the present time; but now our rapid multiplication of free school and free library, with similar tendencies in other educational and recreative lines, is producing its natural result in increased ‘energy.’”

Psychologically speaking, work has made us human beings; without work we should be animals. It now remains for us to

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humanize work; work has enabled us not only to secure our present needs and common luxuries, but also to provide amply for the future. Further, it has taught us to be much more sociable. Work has educated us in a thousand ways; the very universe in which we live is a ceaseless hive of industry.

It is an entirely erroneous idea that the savage is a stronger and healthier being than the civilized man who works in the office, workshop, and factory. Length of life depends upon vitality, and we have abundant proof that our vitality now is greater than when we were savages. The savage allows a great deal of energy to run to waste at irregular intervals, but he has then to take long rests because he has not sufficient energy to carry on continuously. He toils for a period and then rests; he cannot work, for work is psychological and must be methodical. Work liberates man

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from nature and therefore the savage has to be content with what nature provides, and very often he suffers badly in consequence.

Work imparts a quiet dignity to a man which is not seen in the man who wastes all his time. Work is not degrading and an intelligent and diligent man can be distinguished by that impressive dignity. London and all the great towns owe their greatness to the mediæval craftsmen who worked and learned their crafts thoroughly. They were always respected even in those days of feasting and merriment simply because of their dignified ways and because it was realized how essential they were to the country. Method is absolutely essential to business; work must be systematic. Slaves working together realized that they must all pull together if only for their own benefit. So now do we realize that co-operation among competitors is one of the finest

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things in the business world. Systematic work is necessary for us to be able to enjoy leisure. In the past, work was looked upon as an evil to be endured; idleness was the great aim. But now we know that work is essential. In short, the Philosophy of Work is that he gets most from life who invests most of himself in it.

One of the initial problems we have to deal with is the Selection, Adaptation, and Training of employees. So far as machinery is concerned in this country we have in all probability the most efficient in the world, and in our Empire we have abundant raw materials also. But if the secret of reconstruction is increased production, it is more than obvious, in the light of what other countries are doing, that we must increase our Human Efficiency, and to do this we must bring the school to the factory and so bridge the gulf between learning and earning.

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Because of the importance and dignity of business in our social economy, we must above all things carefully select and then most carefully train our employees.

With reference to adaptation and training, we now have certain principles for our guidance which are more or less accepted as axioms of character analysis by experts in charge of the employment department.

CHAPTER V

SELECTING EMPLOYEES

WHATEVER a man thinks and feels,
that he is.

Whatever a man continues to be, that
he writes upon himself.

Whatever a man writes upon himself
can be read by one who understands.

That which is written on a man's face
shows what kind of life he leads.

These statements are axiomatic.

On these principles, the selection of employees depends—that is, if we aim at establishing scientific regimentation in industrial life. Nature has taken millions of years to build the brain of man, therefore

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we can afford to devote a reasonable amount of attention to the problem of organizing and co-ordinating mental processes.

Nature began by building a small portion of brain matter at the back of the skull, and then, with her evolutionary programme, she added layer upon layer, and finally evolved the faculties of reasoning and judgment. And so far as we know, without examining the problem of the genius, nature has finished with the objective mind and endowed man with the propensities of self-consciousness and memory.

We know now that the higher types of men are those with the greatest development in the frontal lobe. If we look for a moment at the heads of such men as Darwin and Spencer, we note at once the immense development of the frontal region of the skull. Their foreheads were massive and show what great thinkers they were. The advancing forehead belongs to the thinker,

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the sloping forehead belongs to the doer, the man of action.

Instinctively we know that features indicate character more or less. Largeness, smallness, coarseness, and fineness of feature all indicate very largely the kind of brain possessed by the candidate for employment, and in this connection it is permissible to state that here we are only observing and translating nature's own handwriting.

There are three influences affecting a man's character, Heredity, Environment, and Habit. To understand himself and to solve the problem of self-determination it is necessary for every man to probe into his pedigree and then realize that he is an expression in time and space of the myriad lives preceding him.

Environment determines to a great extent the bias of the life of the individual, and in the direction of habit lies man's hope or despair.

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All hope of efficiency must come from the daily life of the individual. Habits determine character, and character is oft remote from reputation. We are reminded here of the saying of Homer that "a man's character is his demon"; in other words, it is that which he has inherited, and it has been well stated that "a man's character is what he is by himself in the dark, but his reputation is what he is in the light." The character of a man and his habits can be determined largely by the formation of the face, and it has been proved by experimental psychology that by altering the mode of life and developing the latent faculties a man can completely change his features.

If we refer to the writings of Dr. Blackford and those who follow the school of character analysis by observational diagnosis, we may accept the theory that all types of human beings are reducible to five groups. We have, for instance, the motive

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or square type of face. Persons belonging to this type are the most trustworthy and independent in the world. Lord Kitchener was a man of this type. They are determined, dignified, and scorn to lean on any one else. There is also the vital or round faced type; such persons are full of vitality and are often bubbling over with energy. These are the pleasure-loving, jovial, and substantial people. Then, again, we have the purely mental type—those who have the kite-shaped face. These are the idealists, the highbrows, the people who are minus sentiment. They possess great thinking powers, are very deliberate, exact, and precise in all their actions. As a rule they are most uncompromising and are alert, keen, and practical. We find them amongst the higher professions. Then, again, we have the acid or greyhound type of face; these persons are uncompromising and deliberate, and are invariably keen, practical,

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and penetrating. Finally, we have the alkali or concave type of face; where the features retreat, we find the retreating mind. Where the root of the nose is sunk deeply between the eyes, we find the general disposition to be over-cautious, hesitating, and procrastinating. They have a tendency to put things off until it is too late. Generally speaking, they are mild, reflective, and patient, and strictly speaking, they do not make good business men.

Temperament also can be determined by outside appearances. Light-haired people are generally versatile, brilliant, and fascinating, and often difficult to manage. On the other hand, dark-haired people, because they are in a lower state of vibration, are steadier, more dependable, good organizers, and make excellent managers.

Speaking empirically, it is much easier to manage a dark-haired person than a light-haired one, so that the wise executive

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or works manager will see to it that as far as possible his types and temperaments are balanced up in the workshop, office, or factory. We must mix our human chemicals right to avoid explosions.

In sizing up applicants for a post, great care should be taken to note all these things, although here it may be wise to observe that "a little knowledge is a dangerous thing." Most of our business troubles arise through the vital and alkali types, because these people in the long run think more of their bodily comforts than of their business. If we require a thinker we must choose a combination of the motive, mental, and acid types. Such a person would make a good costing clerk or an accountant. A good salesman is the man who has a slightly receding forehead and a firm, square jaw. They show tenacity of purpose and quick thinking, factors which are absolutely essential to the vocation of a salesman. A man

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with large development on the top and at the back of the head, as a rule, is a man of great moral purpose and character. Such a type makes a good husband, but, strictly speaking, is not always a good man at business because he is for ever striving to serve two masters.

In selecting the employee, great care must be also taken to notice the ears, the lip, and the chin. When the ear is in the centre of the head, this sign usually denotes the man of balanced mind. When the ear slopes near the neck we have the sign of the man of aggression—the fighting or animal man. The upper lip of the business man should be long and straight, for this indicates great power of concentration, cautiousness, and self-control, factors essential in the life of the successful man. The lower lip also gives us a great insight into character. If the lip slightly advances it shows that the person is of a friendly dis-

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position, but where it recedes it shows just the opposite. A square chin indicates tenacity of purpose, but a man with a double chin should not be in an office; he should be outside the factory, working off his spare energy.

Here the reader will say, "What is the use of all these ideas to an employer of labour?" The answer to that question is found in the fact that nature writes upon the features of a man his character, and without being a psychologist it is possible to interpret these signs by close observation and study.

It is better by far to employ the man with the power to take in the work for which he is wanted and to train him than to engage a man totally unsuited for the work because he has been half-trained for it. He will never make any further progress. It is necessary, then, for employers, if they are successfully to compete in the

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coming economic combat throughout the world, to get the right man to do the right thing, at the right time, in the right manner, in the right place, rather than to work by rule-of-thumb methods, and this can only be done by engaging an expert for so great a responsibility, or to train himself to select his employees and then adapt and train them for their work.

The continuous hiring and discharging of operatives, because of their unsuitability for their work, costs modern industry tens of thousands of pounds per annum. In large works it is as essential to have a properly equipped employment department as it is necessary to have a costing department.

It is our intention in the subsequent volume to which this is an introduction to deal much more exhaustively with the subject of vocational adaptation and training, believing as we do that when we have

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solved this problem all those which naturally follow in the economy of business life will more or less solve themselves. The dynamic and the static divisions of our modern industrial life must be thoroughly analyzed and co-ordinated before we can hope for emancipation from the thousand ills which invade our social economy on every side. And here we may usefully refer the reader to the excellent manual of Professor E. D. Jones upon Business Administration, from which the following observations are taken.

“A nearer approach to the scientific control of industrial operations has probably never been made in the world’s history than in those establishments now employing ‘Scientific Management.’ There are men who have shown the world how to save time and toil, how to meet the unexpected with infinite resourcefulness, and how to preserve an unsullied personal honesty

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under the cloak of corporate organization. There are leaders who, without systematic training in youth, have yet built up a new science of affairs, the principles of which can be taught to the coming generations."

Few things will help forward the science of Industrial Administration more than to drop the old question, "How much is he worth?" A true aristocracy will never be formed in Industry until all good men unite to draw the lines sharply, and resolve to give honour only to those who have shown the capacity to observe accurately, to think straight, to preserve their ideals, and to develop productive rather than predatory industries.

In the long run, methods are infinitely more important to industry than the results which at any given moment embody their effects. The prevalence of honourable and efficient methods is the only thing which can keep open the road to future achieve-

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ments. The first care, therefore, of the business community should be sound methods. We hear much of governmental and other reforms which are feared because they will disturb business. It is safe to say that there is hardly any probable destruction of property which will not, in the long run, prove immensely profitable, if it is the price which must be paid for a superior method. To say this is merely to apply the well-established principle of scrapping obsolete equipment to the problem of getting rid of superseded and worn-out methods and policies.

The paramount value of methods was emphasized by Mr. Carnegie when he said, "Take away all our factories, our trade, our avenues of transportation, our money; leave me our organization, and in four years I shall have re-established myself." Results change from day to day; scientific methods are a heritage of intangible capital of more permanent value. Results represent past

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conditions; methods prepare for what is to come. To possess efficient methods is to have the power to recover lost results, or to replace obsolete results at will; but to possess results with inadequate methods is to begin at once to fall behind. Results may be acquired by accident; methods are transmitted only by the slow growth of habits. Results may be easily transferred; to the attainment of superior methods there is happily no royal road.

Science must combine with Industry, and the Scientific Method must be applied to all phases of our economic system. Professor Goldmark in the well-known book upon Fatigue and Efficiency has submitted the most complete analysis upon our main problem to the present-day investigator, and those who wish to proceed further into the problem may wisely direct their attention to the writings of this distinguished scientist.

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Co-operation between labour and capital is the one thing we most ardently desire, and if there is to be a cessation of the futile warfare between the two forces which we may conveniently term Money and Men, we must evolve a higher ideal as to the nature of our common social structure and pay greater attention to the Spencerian doctrine of human solidarity; and we endorse the wise utterings of the American author who stated, with reference to the co-operation of the men of science with the industrialists in making our modern civilization effective and permanent:

“Industry and science agree in making large use of that simple form of co-operation, commonly known as the division of labour, by which persons of unlike genius are united in the same enterprise, for the accomplishment of different functions.

“The dawn of modern science in Europe presented, in the life-history of two noted

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men, a striking instance of the benefits of individual co-operation. Tycho Brahe, the leading astronomer of the latter half of the sixteenth century, was a nobleman of proud spirit and, by reason of a certain dramatic talent which attracted attention, able to secure from his royal patrons large grants for astronomical apparatus. He was an expert instrument maker and an accurate observer. His life was spent largely in compiling tables of observations of planetary movements. Kepler, who came under his patronage, and who worked with him for many years, was a poor observer, suffering from defective eyesight. He was awkward in his movements, and possessed little mechanical ability. He was, however, a good mathematician, and he possessed the rare ability to become enthusiastic over statistical calculations. The five laws of planetary motion which Kepler discovered, and the Rudolphine tables which he com-

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pleted, are monuments to a splendid and devoted co-operation between two geniuses of entirely different endowments.

“Applied science has a similar example of fruitful co-operation in the case of James Watt and Matthew Boulton. Watt has described himself in the following words: ‘I am not enterprising. I would rather face a loaded cannon than settle an account or make a bargain; in short, I find myself out of my sphere when I have anything to do with mankind.’ Boulton was a man of affairs, full of energy and common sense, and possessed of property. He is remembered because he was able to perceive and respect the talent of a man entirely different from himself, and because he tenderly encouraged and courageously defended that genius through manifold attacks and disappointments, to the lasting benefit of the world.

“There are abundant illustrations of the

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fruitful co-operation of men of different talents in business. There are even enough men of wealth ready to enter into an arm's length alliance with science and education by means of a cold bequest. But there is a waiting opportunity for men of affairs to go into living, daily partnership with the arts and sciences, by entering into close personal relationships with men who need the help of a natural administrator to make their contribution to progress. A good many captains of industry might weave their names firmly into the fabric of history, as did Boulton, by aiding some delicate flower of genius with energetic counsel and a wise corrective influence."

The main problem of efficiency of production being that of increasing the human capacity for output on the part of the individual, we shall find it now more than ever necessary in our industrial conferences to pay greater regard to the general prob-

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lem of human efficiency. Because without men we could not possibly utilize our machinery, therefore the man problem is the most urgent of all.

Life at its best is a most difficult equation to solve, and if a man should live to be sixty years of age before he qualifies for a pension, we should take into our reckoning the fact that the average man spends at least twenty years in bed, and if he is to avoid being everlastingly in harness, he has at his disposal thirty years at the most, during which he will be called upon to work out his own economic salvation, make his contribution to the life of the State, and add his quota to the collective welfare of humanity. And unless these principles and ideals actuate his life and animate his endeavour, we can scarcely say that the life of the individual is worth while. We therefore conclude this chapter with the most excellent words of Professor Holmes Merton:

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“Today, in industries, trades, arts, and professions none but efficient men and women are vocationally secure. The unskilled, the inept, the fair-to-middling, the faithful but inefficient are being hard pressed and gradually vanquished, nor is the process of industrial elimination confined to the incapable and the untrained; a sure and unkind fate awaits the capable men who are well-trained for vocations which do not fit them and who, because of this, fail to measure up to the required efficiency standard—sooner or later, they will be discharged from the ranks; and the untried young person, no matter how ambitious and willing or how generally capable he or she is, finds great difficulty in securing employment, and still greater in keeping it, in any but the more ordinary occupations—occupations that offer no future enhancement—unless he or she has had some particular vocational advantages.

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“Efficiency is resolvable into two prime factors, one of which is trained skilfulness. Much emphasis is today being placed on this essential element of success.

“Employers know its value; they discount, sometimes too heavily, all applicants who have not received special preparation for the work required. Employees are sensing its need; and greater numbers of young men and young women are making efforts, some eagerly, some grudgingly, better to qualify themselves for the positions they seek to fill.

“Educators have heard the call of the business and professional world; they are striving to find ways and means by which the demand for men and women better equipped for the practical affairs of life can be met.

“Everywhere there is talk of vocational training, everywhere there is urgency for industrial education. Specialized schools

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generally and the school systems of many cities are modifying their curricula and revolutionizing their methods in order to turn out trained human doers.

“Commissions and foundations are employing large numbers of investigators of the labour and trades situations, with the ultimate object of helping men and women to greater efficiency in their various vocations. Volumes of statistics have been compiled, classes have been conducted, lectures delivered, and many books written concerning vocational training. All of which is effort in the right direction and is productive of partial desired results.

“But in order to produce the highest efficiency product, this one prime factor, trained skilfulness, must be multiplied by the other industrial prime factor, right choice of vocation.

“Right choice of vocation is the natural basis of efficiency.

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“Let a person of intelligence get into the right vocation, even without specialized training in that vocation, and give him a chance to become familiar with its requirements, time to overcome the handicap of unpreparedness, the chances are two to one in his favour that he will make good.

“Were this not true, how account for the thousands of thoroughly efficient men and women in all the avenues of human endeavour in the past years before specific vocational training had been thought of except in certain apprenticeship callings?

“On the other hand, excellent opportunities for acquiring proficiency in any calling for which one has no natural aptitude or mental capacity will never enable one to rise above mediocrity in that calling.

“Oftentimes the best training for a misfit calling does not enable a man even to earn his salt in that calling, whereas the same man might rise to eminence in the

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vocation which called his dominant abilities into play.

“There are two fundamental facts in relation to efficiency that have not received due attention, either in the present-day agitation for vocational training or in the extended, practical efforts that are being made to give young men and women increasingly better preparation for professional and industrial life.

“The first of these facts is that every vocation requires that the man who would successfully follow it with ease and enjoyment must have the special mental equipment—some particular faculty or ability or combination of natural talents—that especially fits him to carry on that occupation; the second of these facts is that profound natural fact that every person is better adapted to carry on some one vocation than he is to carry on any other.

“Before anything like the highest effi-

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ciency of men and women can be developed, vocational training must be supplemented by, or, better, preceded by, vocational guidance. Men and women, boys and girls, need first of all to be helped to make the right choice of vocation. Such fortunate choice of one's work means more than efficiency, more than financial success; it means an unfailing source of happiness. People who do not find their highest self-expression in their work never know one of the most wholesome and enduring joys of human life.

"The new demands of today and of the coming tomorrows require that a person's best abilities and natural gifts shall be called into activity in his life's vocation, require that everyone shall do the work he or she is naturally fitted to do.

"How to find that work is the first great problem.

"The old haphazard way of drifting into any position at hand will no longer serve.

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Too many misfit, incompetent workmen, salesmen, professional and business men have resulted from such a careless chance way of making the most important decision in life.

“In order to find the business, profession, trade, or art where because of one’s peculiar natural fitness for such vocation success may more readily be achieved than elsewhere, one must have, first, a knowledge of one’s own capabilities, developed or latent; and, second, a knowledge of the particular mental requirements of different vocations.”

CHAPTER VI

SCIENTIFIC MANAGEMENT AND THE WEL- FARE OF THE WORKER

THE form of executive control known as Scientific Management is the reduction of known data in connection with a given manufacture to a formula, classifying, tabulating, and reducing each process until the whole becomes an automatic action for the attainment of the maximum output. This is the industrial Gospel of Emerson and Taylor.

The worker is taken and trained to the utmost. The particular process or part of a process for which he shows a particular aptitude is singled out, and reduced to a "task." The "task" becomes that worker's life-work: the only change given to the worker

Scientific Management

is that demanded by fatigue and strain, which, as has been proved, reduce output.

Those responsible for the system claim that they are able to give higher wages for a reduced number of working hours, the incapable worker is eliminated, and better work is produced. It undoubtedly adds great responsibility to the management; the work has to be constantly overlooked, internal organization must be perfected, detail must be constantly adjusted. Its principal objection is that it does not recognize the worker as a social asset; it often fails to make him a better citizen. However, as a system of industrial regimentation it has come to stay.

What is now known as Welfare Work, on the other hand, seeks to secure the best results in all forms of commercial activity by the scientific study of the human element associated with the work of production. It seeks to study the psychology of

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each individual worker, and to fit each person to his work, first selecting and then educating or training the worker.

It seeks to train him so that waste of time or material is not only morally wrong, but a source of loss equally to the employee and employer. It claims that the consideration of either side permits higher wages, and produces more profit. It reacts on the community as a whole; it makes the worker a better citizen and, universally practised, it will largely solve the problem of capital and labour.

It asserts that the "man problem" is the centre of the labour problem, and that this is the element that needs thought and sympathetic consideration.

WELFARE WORK AS AN INVESTMENT

To make a direct charge upon each employee towards the cost of the Welfare

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Department would be a decided error in judgment and defeat the end for which Welfare Work is established. The primary effect of such a charge would be to create a feeling of antagonism, which would militate against the work carried on, and prove harmful to the feeling of confidence between employer and employed, which it is the duty of Welfare Work to engender. Money must not play any direct part in the relations between the Welfare Department on the one side and Capital and Labour on the other, and if an employee ever does think of the cost, it must be in the light of a gift by the Firm.

All firms should view the cost of Welfare Work as an investment, the dividend from which is secured by an unstinted output, lowered costing, effected partly by economical use of material, and largely by reduced waste, and assisted and fostered by a feeling of good-will among all concerned.

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The vision in the mind of the Welfare Superintendent is a busy hive of industry peopled by workers, each doing his bit to attain a greater perfection; the employer doing all in his power to support the Welfare Superintendent in his efforts. He recognizes the value of the work being done, he has secured the good-will of his people, his business has expanded, the practical has made its appeal to him. It has cost him nothing and he has achieved everything.

DOES SCIENTIFIC MANAGEMENT LOWER WAGES?

It is the claim of those who conduct their establishment under Scientific Management that they are enabled by the increased production to pay a larger sum in wages than is otherwise possible under the recognized factory system. The statement is not strictly accurate, inasmuch as a higher

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wage is not always paid, but the earning capacity of the individual is enhanced by a differential bonus scheme, which is governed by output and individual capacity, and not by the raising of the regular wage. This is the centre of much controversy.

It may possibly be rather a fine distinction, but as a question of fact it is a matter of some seriousness to industry as a whole, as this process of weeding out the capable from the incapable must leave its effect upon the community; and here Trade Unionism is placed on its trial.

The answer to the question is in the affirmative, but it is necessary to qualify the reply with a caution that Scientific Management must not be allowed still further to divide the skilled from the unskilled, with the inevitable result that the wages of the one suffer in raising the status of the other. It must be combined with

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technical training, intelligent supervision, and consideration of individual circumstances, and then only will Scientific Management permanently benefit the worker with increased remuneration and the employer by more profitable results.

The Problem of Modern Manufacture can be reduced to very few words: "A fair day's work for a fair day's pay"; it is the duty of the worker to perform the former, and the duty of the manufacturer to provide the latter; but what is a fair day's task for a fair day's pay is not a measurable quantity, and it is this feature that forms the prime difficulty between capital and labour.

Scientific Management claims that it has at least decided one of these issues, for it has reduced the ability to decide a "fair day's work" to an exact science. And it further claims that it has gone a long way on the road towards deciding the share

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that labour may claim as its share of the profits.

The Scientific Manager claims that he is able to pay a larger remuneration than his competitor in the same field, and he asserts that he is able to give shorter hours than factories that are conducted under the old methods. This has been abundantly proved and demonstrated beyond the stage of experiment.

The Welfare Worker views the question from a different outlook, and seeks to humanize the life of those engaged in mill and factory. His claim is that, by studying the individual needs of each worker, and, so far as is practicable, suiting the work to the individual, and making the sphere in which it is carried on congenial, the community as a whole is benefited and the individual worker is filled with greater ambition, enjoys a better life, anticipates his work with pleasure, and is

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altogether a more useful citizen. The desired result is attained: capital receives an adequate return and labour an adequate reward.

APPENDIX A

HANDLING THE HUMAN FACTOR

The Military System.—The divisional system is sometimes termed the “Military” system, and although this form is frequently caricatured, the “Military” or “Line” system has carried the burden of our industrial arts for many decades, and we must admit it did it exceedingly well. Military systems today, which are supplemented by the Intelligence Department, can be pointed out as in successful operation at much less cost than more highly elaborate systems. This latter system is one which cannot be over-emphasized. However, the real difficulty in this connection, in the thoroughly organized military shop system, is that of

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human limitations: (1) the number of people who can be effectively supervised and instructed; (2) the number of things that can be planned by any single individual reaches its limit at the plant unit growth and the system begins to fall in the scale of efficiency thereafter, because one man seldom can effectively supervise a multitude of operatives.

The Functional System operates along the line largely of regimentation plus the closer contact with the employee. Whenever the element of personal contact with the workman, by supervising divisional officers, ceases, the corresponding necessity for the smaller departmental unit control arises. In this connection some confusion at present exists, and it is supposed by many, and asserted by some, that there is a particular economic virtue in pressing departmental systems into the extreme functional forms. Yet, here again, in actual

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practice we encounter Human Nature and we are brought to realize that shop management is an Art rather than a Science and that it has to deal with too many unknown and uncharted quantities and variables before it can aspire to scientific rank or become a fixed commercial creed. Our intention is that all our efforts in system should be directed toward developing a science of each industry, but before we can have anything in the nature of science we await the intensive development of the industrial engineer himself. Let it then be said that there is, in fact, no royal road to shop efficiency. The great problem of the Human Equation cannot in the very nature of things be solved by any system as such, because what is now known as scientific management is in the throes and perils of experimentation. It may be said without any misgiving that more often than not the great problem facing the Depart-

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mental Manager is not so much the man whose work he supervises as the problem of Himself. Departments that are highly functionalized in supervising, in order to fix responsibility, often fail in practice. Hence the need of science and system and the analysis of the complex problem of the human.

The Departmental System, on the other hand, as distinguished from the functional, lays down no dogmatic rule on industry. It has no quarrel with initiative and incentive. It does not seek their extinction as some systems do, but rather their wise control. In a good organization, and aided by first-class intelligence and method-study divisions—for these elements are not peculiar to one particular system—it splits up the shops into units of control of reasonable size, supplies the best staff assistance, apparatus, material, and scientific instructions, leaves the head of each department

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full control within his sphere, and holds him solely responsible for increasingly efficient results. In getting these he may functionalize more highly in some directions than in others, but he does so not because of any obligation under an inflexible system to follow that course, but owing to the proved desirability of it. This then is true scientific management, management according to knowledge of the facts of the case and not according to theories previously framed to suit external facts.

SUPPLEMENTARY

We append seven rules with regard to the efficiency of office and plant routine, which should be observed irrespective of the class of work done:

(1) Have a well-considered system of doing things, definite and businesslike in all departments, not an imitation of some-

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thing else, but one designed for your own use.

(2) See that a broad view of the subject is taken, and provision made for properly dovetailing the various departmental systems.

(3) Make the connection clear to all employees by the use of a chart. Such a table is self-interpreting and saves much explanation.

(4) Have as little system and as few forms as possible. Make them a means, not an end. There are many daily items of shop practice being perpetuated in expensive card systems today, of which no use whatever is being made, or is ever likely to be made.

(5) Do not treat the system as a fetish. It is a good servant, but a bad master. So much of it as is justifiable is merely organized common sense. Prune and pare your system without stint, until it gives the utmost economy and dispatch.

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(6) Do not fail to note closely what your system costs, and if it is really paying its way. Very few can answer that question. With many it is purely a matter of faith.

(7) Be always on the lookout for improvements and suggestions from any responsible quarter, and discriminating in adopting them.

Modern system in the Production Department should receive the hearty and discriminating support of all plant managers. The latter will increasingly be drawn from the ranks of those who have added to a thoroughly practical executive discipline in the shops a full comprehension of what system can, and also what it cannot, accomplish.

The amount of modern system we need in our industries bids fair amply to justify itself by its efficiency, particularly in the lean years. The rest is deadweight, and should go promptly overboard.

APPENDIX B

TRAINING EXECUTIVES FOR EFFICIENCY

EACH step forward in the reconstruction of our industrial machine brings us nearer to that point where problems of Management and Administration become more difficult and in many cases more abstract. We are called upon to organize more effectively the basic administrative units in our offices and in our shops and factories. There is an increasing demand for efficient managers, superintendents, and captains in our industrial divisions. In short, we must, by all manner of means and at all costs, obtain the competent individual and secure efficiency.

Each branch of Industry is seeking for a

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solution of the problem of efficiency, sometimes at the expense of other departments and often without any real sense of the interdependence and interlocking of organization units. Whatever else we fail to get, we must have co-ordination, but the pressure of events is effecting some change in our attitude towards this matter. The truth of the matter is that until we can articulate the units of organization into a more scientific structure, their amplification (in view of the splitting up of the mechanical processes of labour and standardization) may easily become an overwhelming embarrassment. So that now, rather than look for more men, we are seeking for those ideas and bases of action which will most effectively co-ordinate and harmonize the power of the men we have. Difficulties of the kind that arise today are of such magnitude and involve the proper adjustment of so many interests, the co-ordination of so many

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agencies, as to be baffling in the extreme. We have no counterpart in the economic evolution of industrialism. We are as men sailing on an uncharted sea. The centralization of authority fundamental to the discussion of nearly all such matters is the question of the degree of centralization of administrative authority, with the subsidiary problem of correct and balanced decentralization. And here we shall probably find the solution by adopting what is called the military principle of industrial regimentation. It would appear that a maximum of centralization, which is undesirable (as is too much decentralization), is obnoxious. Either extreme may create inefficiency. The policy of the captains of industry should be rather to aim at that degree of decentralization that is consistent with a strong, potent, and far-sighted central control. Here again, however, in bringing about this type of administrative

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control, there are many difficulties to be encountered; for we are told that our new democracy must turn to industrial absolutism for its model, if it seeks, first of all, to be efficient and, finally, effective. In this theory of management we shall have our industrial institutions modelled on the type organized by the man who is known as the Captain of Industry.

But here we must not leave out of our industrial system the great problem, the essential consent of the employee in the adoption of these schemes of the scientific correlation and regimentation of industrial administration. We must develop in every unit of organization the desire for a common leadership and an ability to respond to that leadership when it is intelligent. *Here we meet with the problem of Functional and Staff Training*, and the development of that personal factor of efficiency without which there can be no such thing as loyalty, har-

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mony, and that correct disposition on the part of the worker which eventuates in the happiness of all. But more important even than this, we must develop as our leaders of industry men who realize that their capacity for leadership is conditioned by the loyalty of those they seek to lead, and they must be men to whom facts are masters and whose scientific training ensures the higher degree of efficiency and management. These top controls, which must necessarily be established, will, when thoroughly co-ordinated and made scientific, be beyond anything we have ever dealt with in industry. It will be the function of these super-organizations to seek out the inner theories of action, to enunciate policies, record performance, and capitalize experience.

The organization of any form of top control can only proceed as we develop the organization of each of the units the activities of which are eventually to be correlated.

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Little authority of this kind exists, except in great combines and monopolistic concentrations, and what we have stated herein is as a sign-post pointing out the road along which we must inevitably and eventually travel to our industrial Utopia.

APPENDIX C

HOW TO ESTABLISH AN EFFICIENCY CLUB

A PRELIMINARY Meeting of the Staff is called, presided over by the Management, at which the Aims and Objects of the Club are outlined and a synopsis of the course of training, etc., submitted and explained.

It is usual for the Management to select from each Department the most promising Members of the Staff, and these form the nucleus of the Club, or, in some cases, the entire Staff may be taken in groups by rotation.

The House or Works Club would be controlled by the Executive of the Company, who fix the place of meeting and the time, and lectures and demonstrations are given.

How to Establish An Efficiency Club

The Meetings are held during or after business hours, and take place as frequently as convenient, or are arranged for weekly or at least once a month.

Intermediate Meetings should be encouraged among the Staff, where among themselves the Members of the Club discuss the problems arising out of each Lecture and their daily experience in the dispatch of departmental duties.

RULES AND REGULATIONS

Rules are drawn up by the Executive for the conduct of the Club, and a Secretary is appointed to keep minutes and a permanent record of all Meetings. A verbatim, revised Report of each Lecture is given to each Member.

A regular report is submitted to the Executive in order to assess the results attained by the Club as a whole and so

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register progress. It is usual for the course of training to extend over a period of twelve months, but it may be abbreviated and adapted to the domestic and local conditions of the Firm or Company.

It may be indicated that the technical routine and system of the firm are not trenched upon except incidentally, because this factor is mainly the province of the Executive and the Management.

COST OF SUCH A TRAINING

If an Instructor is brought into the Works from outside it is usual for the Company to pay the fees of the Members, or otherwise contract for the services of the Lecturer or Instructor, unless training is undertaken by the Management. In some instances the Company itself would prefer to pay the entire cost of the course of training and control its administration.

How to Establish An Efficiency Club

In order to foster a spirit of co-operation aiming at the attainment of a higher percentage of result, some firms adopt a co-operative system whereby the Members of the House Club pay part of the cost of training, the Members' payment being spread over a given period in instalments and is returnable for those who attain the highest grades of efficiency. The course of study or training should cover such subjects as:

A History of the Firm: The Nature of its Product: Conditions of Manufacture. Business Considered as a Science. The Aims and Objects of Business Life. The Service Idea and its Relation to the Company: Relation between Learning and Earning: Cultivation of Initiative: Value of Personality in Business. Personal Efficiency and the Laws of Health: Self-discipline: Training the Will. How to Obtain Mental Efficiency: What the Mind is and How it

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Works. The Cultivation of Tact, Courtesy, Order, and Promptness. How to Save Time, Energy, and Money, and Eliminate Waste. Efficiency in Methods of Work: The use of Time and Motion Study. How to Organize Oneself: Self-Education. Business Ethics: Fatal Habits Easily Acquired: The Need for Loyalty and Co-operation: Reliability and Honesty: The Habits of System and Punctuality: The Interdependence of Departments, etc.

This brief digest may be suggestive of other ideas which may fit in with the local and domestic needs of the firm. In any case such an educational scheme has now come to be recognized as being as necessary as a costing department or a sales department.

Considering the problem of training employees in the Works to the end that they may get adequate insight into the nature and character of their daily duties and the

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relation *of same* to the efficiency of the whole concern, it has been found in actual practice that a scheme such as is outlined above is most effective in the production of results and the development of the personal factor to the very highest degree of efficiency.

The method suggested may be deemed new, and in some senses novel, but the fact remains that such an organization within the works, rightly conducted, would eliminate most, if not all, of the troubles which arise through departmental misunderstanding and jealousy—the most perilous negative factor in any institution.

Executives who aim at efficient management will soon find that the adoption of such a scheme, adapted to local needs, would create that essential atmosphere among the workers without which there can never be true efficiency.

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